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FRUIT FLY CONTROL WITH POISONED-BAIT SPRAYS IN HAWAII

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A poisoned-bait spray containing malathion and one of several types of protein hydrolysates will give good control of the oriental fruit fly (Dacus dorsalis Hendel), the melon fly (Dacus cucurbitae Coq.), and the Mediterranean fruit fly (Ceratitis capitata Wied.) for as long as 2 weeks. The fruit flies are attracted to the protein hydrolysate, which contains nutrients essential for their sexual development, and they quickly ingest enough of the insecticide to kill them. The contact action of the deposits and contamination of natural food sources also contribute to fly mortality.

In tests conducted in Hawaii since 1950, this bait spray has given good control of infestations of the oriental fruit fly in mango, guava, citrus, and passion fruit; of the melon fly in passion fruit, tomato, cucumber, squash, cantaloupe, and watermelon; of the Mediterranean fruit fly in peaches and loquats; and of mixed infestations of two or more species in guava, peaches, and passion fruit. It was recently used at 1 gallon per acre in aerial sprays on more than 800,000 acres in Florida to eradicate the 1956 Mediterranean fruit fly infestation in that State.

When used as recommended, this bait spray has not reduced the parasitization by established species in Hawaii. The protein hydrolysate does not attract parasites, the insecticide is less harmful to them than DDT and its related compounds, and the reduced application rate compared with nonbait spray requirements results in less contact and residual action against all beneficial insects.

Fruit flies generally concentrate their attack on ripe or ripening fruits and vegetables. The melon fly is also especially destructive to vine tips and buds of cucurbits, and this and other species in Hawaii attack newly set passion fruit. The egg punctures provide easy entry for rots and reduce fruit grades by causing calloused areas. The maggots feed on the flesh of the fruit or infested portions of the vines and cause decay. Egg punctures or young maggots in soft immature fruits cause them to drop or develop abnormally, and may substantially reduce the set of fruit. Heavy attacks by the melon fly and oriental fruit fly in Hawaii often prevent passion fruit from setting a satisfactory crop. Some crops well adapted to Hawaii are not grown because of previous failures due to fruit fly attack.

These bait sprays, when properly used, cause no injury to fruit or foliage of the crops mentioned, nor do they leave harmful residues on edible fruits or vegetables. They are therefore recommended in preference to nonbait sprays for the protection of fruits and vegetables from fly attack. In general, it has been found that the attractant increases the sprays' effectiveness so that only one-fourth to one-half as much insecticide is needed. Since bait sprays are more effective when applied in concentrated form, costs are reduced through the use of less water as well as less insecticide. Concentrated bait sprays, applied in well-distributed, coarse droplets, leave deposits of poisoned fly food that are likely to be more attractive than honeydew or other natural foods for several days. Dilute bait sprays, utilizing water up to the point of run off, may have a greater initial attraction to fruit flies but will generally lose effectiveness within a week.

Malathion in wettable-powder form is the only insecticide that is recommended at present for use in protein hydrolysate bait sprays. If used as directed, its deposits will always outlast those of the attractant; so there is no danger of attracting flies without killing them. Experiments have indicated that some of the new materials, such as Dipterex, Guthion, and Dow ET-57 (Korlan) may be useful, but more research on them is needed. Parathion is more effective than malathion, but is not recommended because of harvest restrictions. Fresh deposits of protein hydrolysate sprays are especially effective and will attract flies from different distances depending on the area sprayed and the amount applied. For this reason good control may sometimes be obtained on adjacent unsprayed crops. Such fly-population depletion in the vicinity of bait-sprayed areas will result in less migration into the planting after deposits weaken. Nonbait sprays have little effect beyond the borders of the treated areas.

Preparation of Bait Sprays

Use one of the following formulas according to your equipment and the minimum amount of water needed to insure adequate distribution. The quantities given are sufficient to treat 1 acre.

Ingredient	Airplane or mist blower	Conventional power sprayer	Knapsack sprayer
Water	1 to 15 gallons	20 to 100 gallons	3 gallons
Protein hydrolysate	1 pound	1 pound	1 pound
Malathion 25 WP	2 to 3 pounds	3 pounds	2 pounds

If you have a liquid acid hydrolysate that contains only 50 percent of solids, use 2 pounds. If you apply more than 10 gallons of water per acre, use 3 pounds of malathion.

Dissolve the protein hydrolysate in the water, stir, and add the malathion wettable powder. The inclusion of sugar sometimes improves performance against the oriental fruit fly and Medfly, but reduces effectiveness against the melon fly. Its use is not recommended.

This bait spray will cost from $1.50 to $3.00 per acre, depending upon the type of protein hydrolysate that is used.

Application

Apply the bait spray on the day it is prepared. Keep the mixture agitated while spraying.

Dosages are calculated on a per-acre basis, since the water functions only as a carrier and the degree of attraction to fruit flies is largely proportional to the amount of protein hydrolysate per unit area. If all spray is applied to the crop, the ground area covered by the crop determines the acreage. If plants or trees are scattered, the area they cover may be much less than an acre and require proportionately less spray. However, if airplane, mist blower, or a fixed-nozzle boom on a conventional sprayer is used, and the spray is applied to ground and vegetation alike, then no allowance can be made for areas not covered by the crops to be protected. When low-growing or vegetable plantings are sprayed, higher border vegetation should be included, particularly if the plot is of less than an acre. Another application will generally be needed when the accumulated precipitation exceeds 1 inch.

On areas of an acre or less where the proportion of immigrating to locally produced flies is high, the suggested dosages may have to be doubled and applied weekly. In contrast, on crops covering several acres, or if the probable fly immigration is small, the recommended or lower dosages applied at 10-day to 2-week intervals may be sufficient provided there is no rain in the first 2 hours after the application.

Apply the spray evenly to all plants or trees in scattered small droplets. Complete coverage is not necessary. Avoid drenching any part of the plant, because of the residue and plant-injury hazard from heavy concentrated-spray deposits. Sprays deposited on the under side of foliage are generally effective longer than those applied to the upper surface. Deposits on the fruit, branches, or artificial surfaces rarely induce feeding, though they may attract flies to nearby foliage. Bait sprays usually attract twice as many females as males. Well-fed flies may be slow to respond, and mature females may lay some eggs before they are killed, although they generally respond to the deposits as well as those that are sexually immature.

Do not apply bait sprays in combination with other insecticides or fungicides. Tribasic copper sulfate destroys all attraction, and residues of this fungicide reduce the attraction of bait sprays applied over them. Apply any fungicide in dilute spray 1 or 2 days before the bait spray. The more concentrated the bait spray, the less will it be affected by a fungicide.

Attractants

Protein hydrolysates may be derived from corn protein, wheat gluten, casein, Brewer's yeast, animal products, or various other sources. They are available in powder or granular form produced by enzymatic action, or in dry or liquid form (containing about 50 percent of solids) produced by acid hydrolysis. The acid hydrolysates generally cost about 12 cents or more per pound, the enzymatic types $1.00 or more f.o.b. manufacturer.

The enzymatic types absorb moisture from the air and must be stored in airtight containers to avoid caking. Partially hydrolyzed yeast hydrolysate, one of the cheaper forms, is less effective than fully hydrolyzed types. The acid hydrolysates contain sodium and ammonium salts, which may cause injury if parts of the plants are drenched. They have caused no injury on mango, citrus, avocado, peaches, and most hardy plants, and have been used successfully on cucumbers and tomatoes. No plant injury has been observed following use of enzymatic protein hydrolysates.

Not all protein hydrolysates are attractive to fruit flies. The following products have been tested most extensively and found attractive to the three species present in Hawaii:

Enzymatic protein hydrolysates
- AB-1003 or partially hydrolyzed yeast hydrolysate. Marvin R. Thompson Co., Stamford, Conn.
- Enzymatic yeast hydrolysate. Nutritional Biochemical Corp., Cleveland, Ohio
- Type M or Type A Fleischmann's yeast autolysate. Standard Brands, Inc., New York, N. Y.
- Amber BYF yeast hydrolysate. Amber Laboratories, Inc., Milwaukee, Wis.

Acid hydrolysates
- Insect bait No. 2 (from corn protein) or bait No. 7 (from corn protein and steep water). A. E. Staley Mfg. Co., Decatur, Ill.
- DSC (powder). Huron Milling Division, Hercules Powder Co., Wilmington, Del.

Mention of these manufacturers does not constitute endorsement of their products by the Department of Agriculture.

The list may be expanded after more research is completed on hydrolyzed animal proteins and on other sources of acid hydrolysates. Growers in Hawaii who wish to buy through local dealers should allow ample time for procurement from the mainland.

Precautions

Malathion is less poisonous to man and animals than some other insecticides. It has been employed extensively for controlling agricultural pests in concentrations much higher than recommended for this bait spray. However, it may cause trouble if it gets into the eyes or is swallowed, inhaled, or absorbed through the skin. Take special care when working with concentrated sprays or powders. Observe the precautions on the manufacturer's label.

Guavas, mangoes, citrus, passion fruit, melons, cantaloupes, cucumbers, or tomatoes may be harvested the day after spraying without removal of residues. Fruit picked and consumed on the day of spraying should be washed before use. If the spray is applied to fruits smaller than common guavas, such as strawberry guavas, plums, or small-tomato varieties, the interval between the last spraying and harvest should be 3 days. Sprays should not be applied to small pubescent-covered peaches within 7 days of harvest. Bait sprays containing malathion may soften lacquer-type automobile finishes if not flushed off with water soon after deposition.

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These bait sprays were developed at the Hawaiian laboratory of the Entomology Research Division. Research conducted by the University of California provided basic information on the importance of protein hydrolysates to the oriental fruit fly diet. The Hawaii Agricultural Experiment Station, the Territorial Board of Agriculture and Forestry, the Hawaiian Sugar Planters' Association Experiment Station, the Pineapple Research Institute, and local pineapple companies and farmers provided facilities of much value in the conduct of this research.

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